31. (New claim) A method for preparing a library of compounds comprising:

contacting a purine or pyrimidine heterocyclic scaffold having at least two functionalizable atoms, wherein at least one of said functionalizable atoms is blocked, with a mixture of at least six different chemical substituents to append each of said chemical substituents to said heterocyclic scaffold directly to form a substituent-appended scaffold;

deblocking at least one of said blocked functionalizable atoms of said substituent-appended scaffold; and

contacting said substituent-appended scaffold with a mixture of at least six different chemical substituents to append each of said chemical substituents to said substituent-appended scaffold either directly or via a tether moiety covalently attached to one of said functionalizable atoms.

32. (New claim) The method of claim 31 wherein said compounds of said library are within 20 mole percent of equimolarity.

33. (New claim) The method of claim 31 wherein said contacting steps are carried out in one reaction vessel.

34. (New claim) The method of claim 31 wherein said purine or pyrimidine is substituted or unsubstituted adenine, guanine, cytosine, uridine, thymine, xanthine or hypoxanthine.

35. (New claim) The method of claim 31 wherein said scaffold is contacted with a mixture of at least ten different chemical substituents.

36. (New claim) The method of claim 31 wherein said scaffold is contacted with a mixture of at least fifteen different chemical substituents.

37. (New claim) The method of claim 31 wherein said method is performed in solution phase.

38. (New claim) A method for preparing a library of compounds comprising:

contacting a purine or pyrimidine heterocyclic scaffold having at least two functionalizable atoms, wherein at least one of said functionalizable atoms is blocked, with a mixture of at least six different chemical substituents to append each of said chemical substituents to said heterocyclic scaffold via a tether moiety covalently attached to one of said functionalizable atoms to form a substituent-appended scaffold;

deblocking at least one of said blocked functionalizable atoms of said substituent-appended scaffold; and

contacting said substituent-appended scaffold with a mixture of at least six different chemical substituents to append each of said chemical substituents to said substituent-appended scaffold either directly or via a tether moiety covalently attached to one of said functionalizable atoms.

39. (New claim) The method of claim 38 wherein said compounds of said library are within 20 mole percent of equimolarity.

40. (New claim) The method of claim 38 wherein said contacting steps are carried out in one reaction vessel.

41. (New claim) The method of claim 38 wherein said purine or pyrimidine is substituted or unsubstituted adenine, guanine, cytosine, uridine, thymine, xanthine or hypoxanthine.

42. (New claim) The method of claim 38 wherein said scaffold is contacted with a mixture of at least ten different chemical substituents.

43. (New claim) The method of claim 38 wherein said scaffold is contacted with a mixture of at least fifteen different chemical substituents.

44. (New claim) The method of claim 38 wherein said method is performed in solution phase.